AI4NetMon 2.0

Artificial intelligence (AI) methods and tools for improving network monitoring practices

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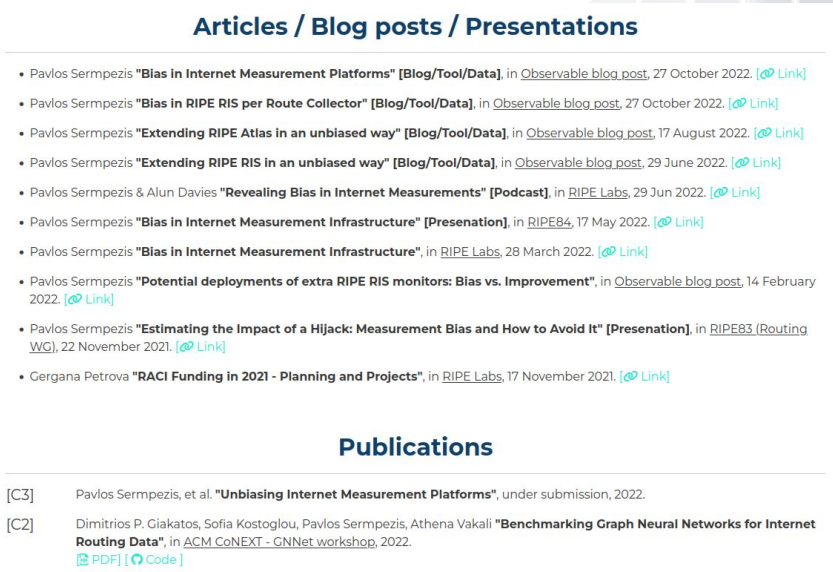
The AI4NetMon 1.0 project

- Funded by RIPE NCC [RACI project funding 2021](#) program
- Project's website: https://ai4netmon.csd.auth.gr/
- Github repo: https://github.com/sermpezis/ai4netmon
- Goals:
  - ***quantify bias*** in Internet measurement platforms (RIPE Atlas, RIPE RIS, etc.)
  - ***unbias*** Internet measurement platforms



Articles / Blog posts / Presentations

- Pavlos Sermpezis **"Bias in Internet Measurement Platforms" [Blog/Tool/Data]**, in Observable blog post, 27 October 2022. [Link]
- Pavlos Sermpezis **"Bias in RIPE RIS per Route Collector" [Blog/Tool/Data]**, in Observable blog post, 27 October 2022. [Link]
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- Pavlos Sermpezis & Alun Davies **"Revealing Bias in Internet Measurements" [Podcast]**, in RIPE Labs, 29 Jun 2022. [Link]
- Pavlos Sermpezis **"Bias in Internet Measurement Infrastructure" [Presenation]**, in RIPE84, 17 May 2022. [Link]
- Pavlos Sermpezis **"Bias in Internet Measurement Infrastructure"**, in RIPE Labs, 28 March 2022. [Link]
- Pavlos Sermpezis **"Potential deployments of extra RIPE RIS monitors: Bias vs. Improvement"**, in Observable blog post, 14 February 2022. [Link]
- Pavlos Sermpezis **"Estimating the Impact of a Hijack: Measurement Bias and How to Avoid It" [Presenation]**, in RIPE83 (Routing WG), 22 November 2021. [Link]
- Gergana Petrova **"RACI Funding in 2021 - Planning and Projects"**, in RIPE Labs, 17 November 2021. [Link]

Publications

[C3] Pavlos Sermpezis, et al. **"Unbiasing Internet Measurement Platforms"**, under submission, 2022.

[C2] Dimitrios P. Giakatos, Sofia Kostoglou, Pavlos Sermpezis, Athena Vakali **"Benchmarking Graph Neural Networks for Internet Routing Data"**, in ACM CoNEXT - GNNet workshop, 2022.
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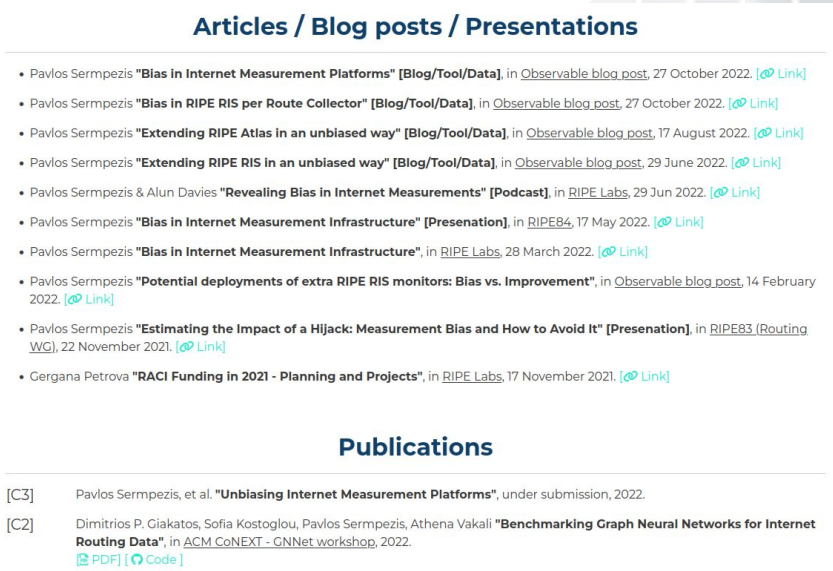

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AI4NetMon 2.0 → focus on measurements
(instead of entire platforms)

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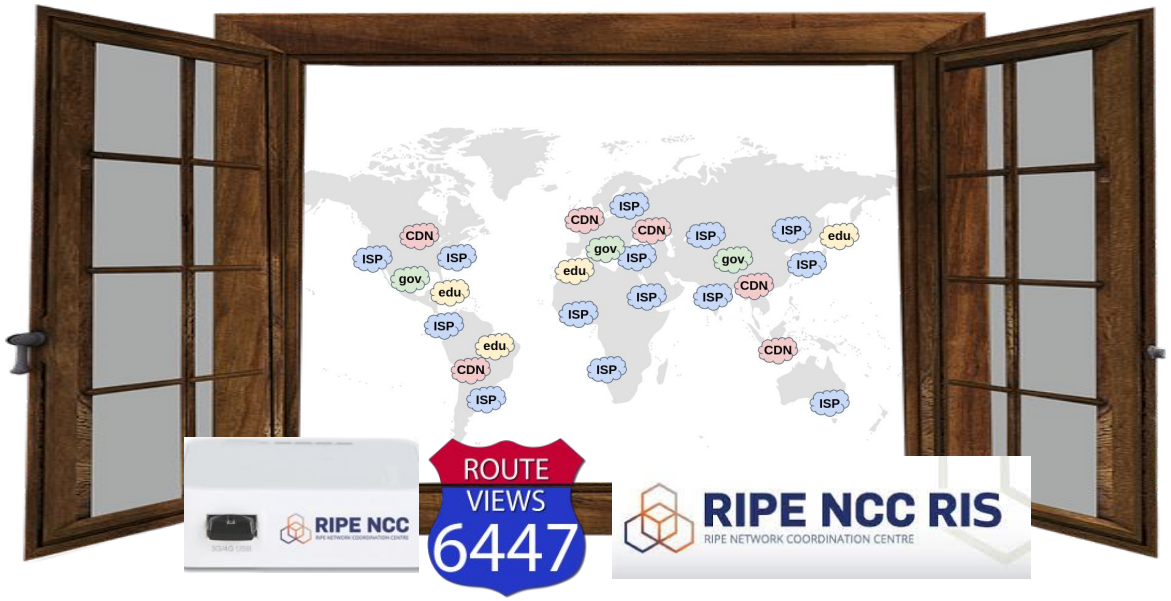
Internet measurement platforms: a (stained glass) window to the Internet

Ideal (unbiased)



Internet measurement platforms: a (stained glass) window to the Internet

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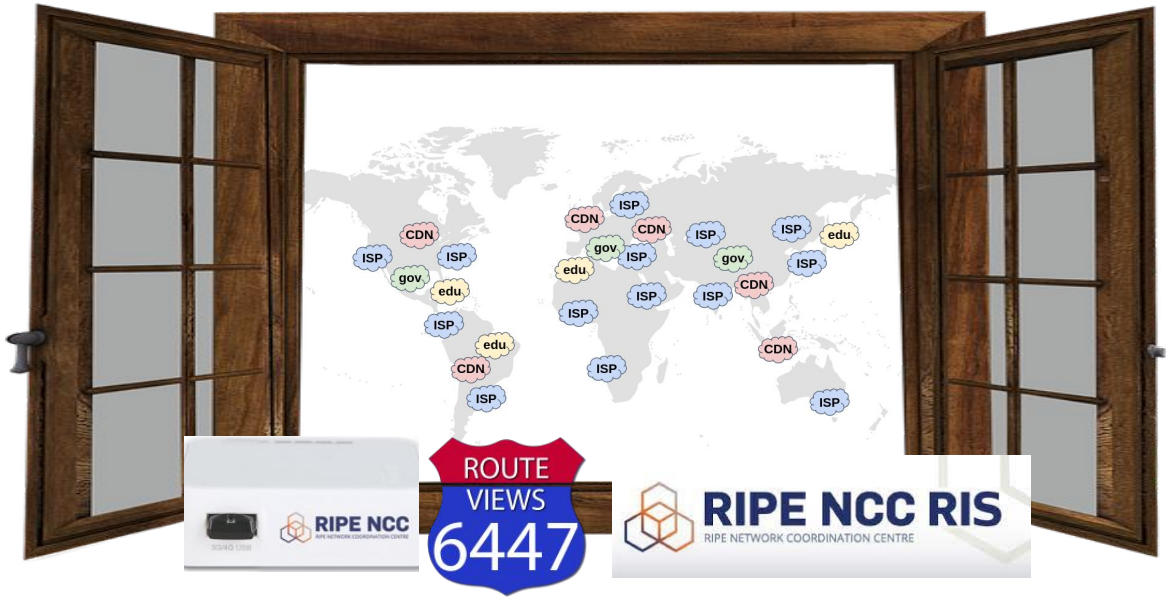

In reality (biased)

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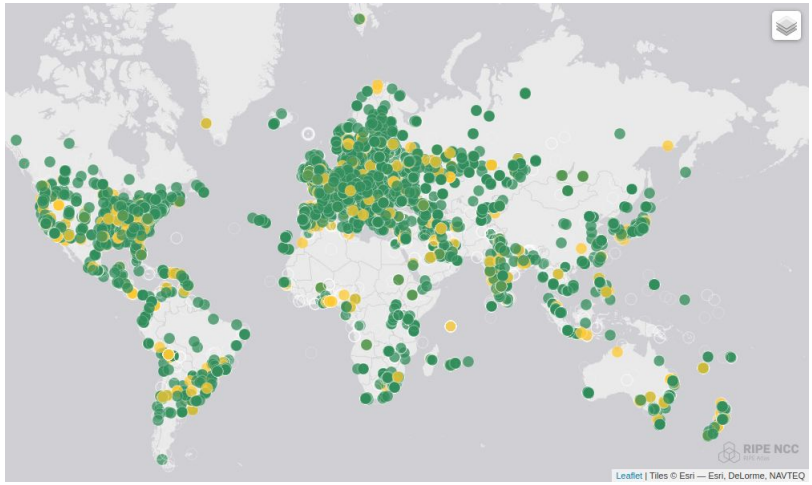
Why there is bias?

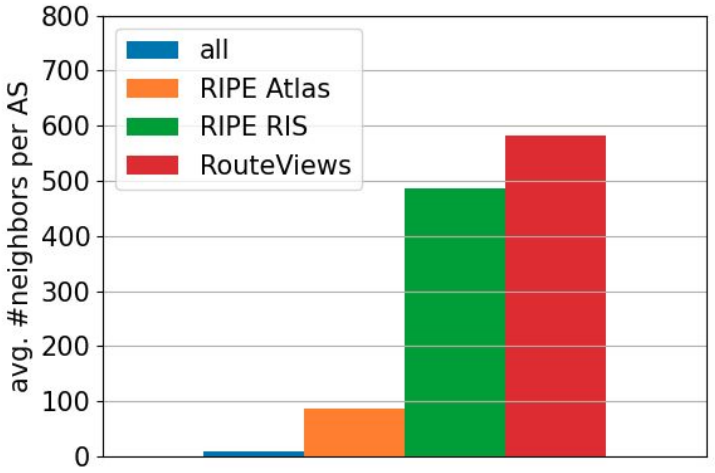
Example 1: location bias



RIPE Atlas probes

https://atlas.ripe.net/results/maps/network-coverage/

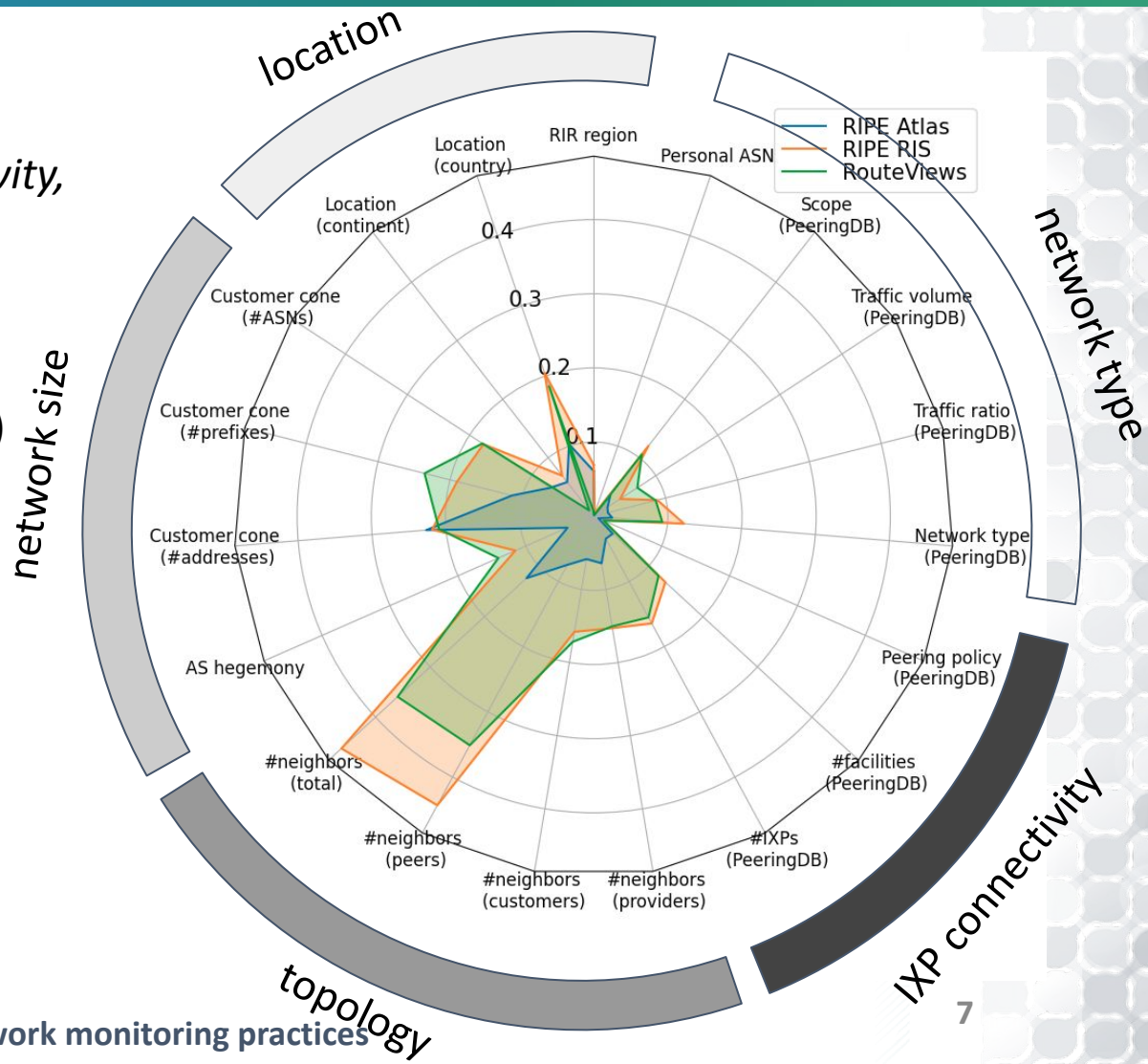
Example 2: topology bias



RIPE RIS / RouteViews peers have much more peering links ("neighbors") compared to an average AS

Results: Bias in Internet measurement platforms

- Many dimensions of bias
  - *location, network size, topology, IXP connectivity, network type, etc.*
- Bias score per dimension
  - a value between 0 (low bias) and 1 (high bias)
- Radar plot of bias
  - each radius → a bias dimension
  - colored lines/areas → bias score
  - high bias → far from center



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AI4NetMon tool 1: “Show me the bias”

- Online tool: https://observablehq.com/@pavlos/ai4netmon-bias

[Optional] Select a different **custom set** of vantage points

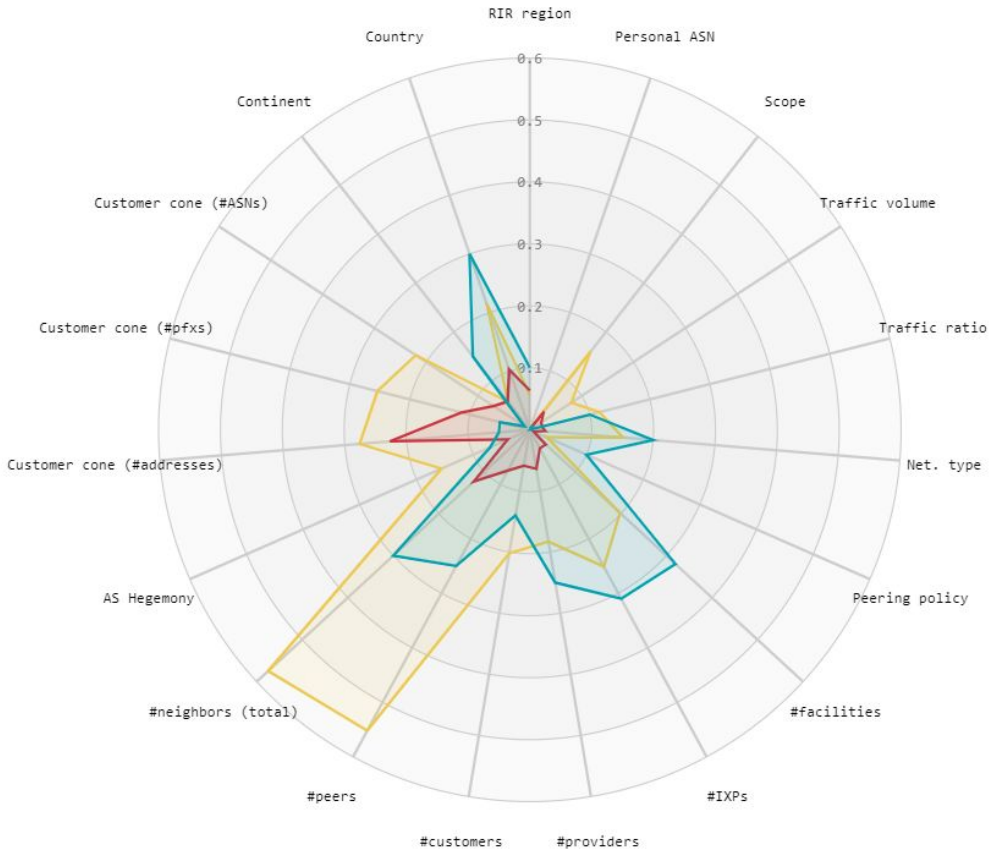
Set of vantage points (ASNs) e.g., AS123, AS234, AS456

Select the sets of vantage points to visualize

Monitor sets ☑ RIPE RIS ☑ RIPE Atlas ☑ My Custom Set

Select the bias dimensions to visualize

Bias dimensions
☑ RIR region ☑ Country ☑ Continent ☑ Customer cone (#ASNs)
☑ Customer cone (#pfxs) ☑ Customer cone (#addresses) ☑ AS Hegemony
☑ #neighbors (total) ☑ #peers ☑ #customers ☑ #providers ☑ #IXPs
☑ #facilities ☑ Peering policy ☑ Net. type ☑ Traffic ratio
☑ Traffic volume ☑ Scope ☑ Personal ASN



AI4NetMon tool 1: “Show me the bias”

- Online tool: https://observablehq.com/@pavlos/ai4netmon-bias

- Select custom set of vantage points
- Automatic visualization of bias
- Easy comparison between platforms / sets

[Optional] Select a different **custom set** of vantage points

Set of vantage points (ASNs): e.g., AS123, AS234, AS456

Select the sets of vantage points to visualize

Monitor sets: ☑ RIPE RIS ☑ RIPE Atlas ☑ My Custom Set

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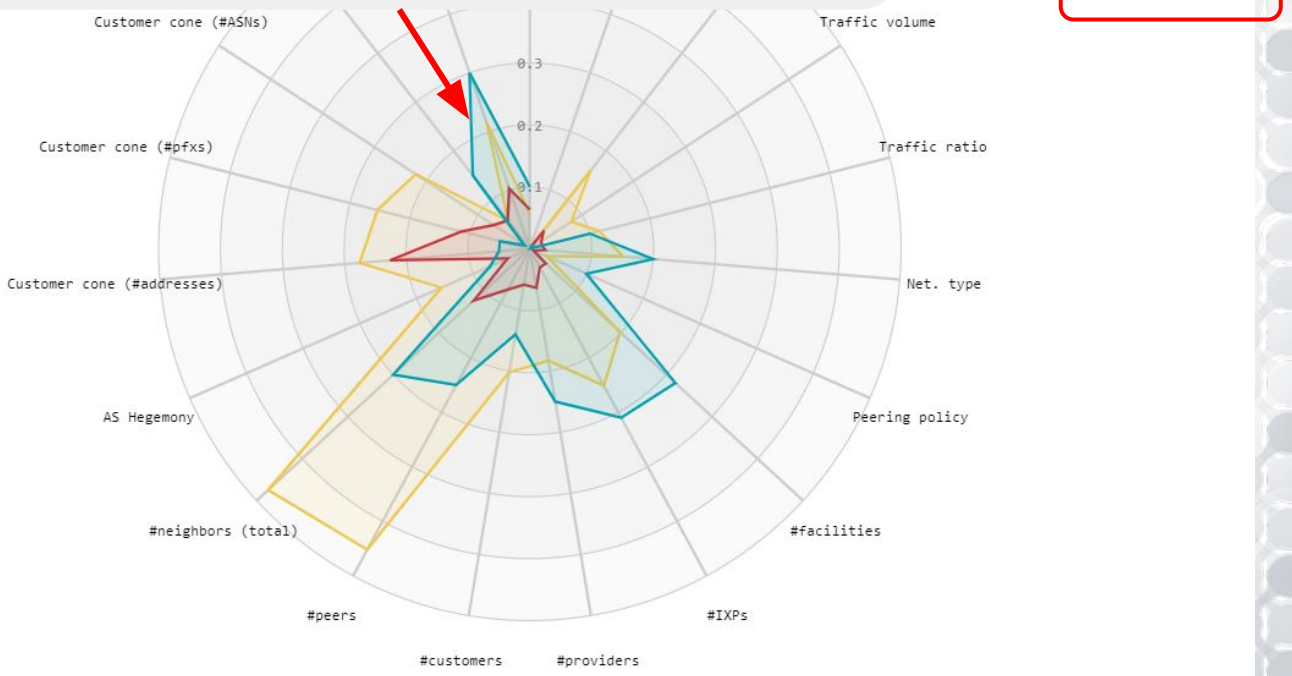

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AI4NetMon tool 2: API

- The API is available at https://ai4netmon.csd.auth.gr/api/
- Endpoint for bias calculation: **/bias/{params}**

- Options for {params} - Internet measurement platforms
  - Atlas
  - RIS
  - RouteViews
  - RIS&RouteViews
  - rrc00
  - …
  - rrc26
- Options for {params} - any custom list of ASNs / vantage points
  - ?asn=123&asn=456&...&asn=789

AI4NetMon tool 3: recommending vantage point deployment

- Online tools (current version)
  - RIPE RIS: https://observablehq.com/@pavlos/ai4netmon-ripe-ris-extension
  - RIPE Atlas: https://observablehq.com/@pavlos/ai4netmon-ripe-atlas-extension

Quick view: top-5 recommendations (see below the complete data & options)

ASN	RIR	Country	TOTAL bias
AS138222	APNIC	IN	-3.08%
AS134324	APNIC	IN	-3.02%
AS134873	APNIC	IN	-3.02%
AS138248	APNIC	IN	-3.02%
AS138287	APNIC	IN	-3.02%

RIPE RIS

Quick view: top-5 recommendations (see below

ASN	RIR	Country	TOTAL bias
AS329031	AFRINIC	NG	-1.40%
AS28345	LACNIC	BR	-1.37%
AS26162	LACNIC	BR	-1.35%
AS61524	LACNIC	CL	-1.27%
AS263290	LACNIC	BR	-1.23%

RIPE Atlas

AI4NetMon 2.0 - objectives

- Web portal (& open source code)
  - Quantify bias of a measurement setup (e.g., selected RIPE Atlas probes)
  - Identify reasons of bias
  - Provide recommendations for reducing bias (e.g., recommend alternative Atlas probes)

- Analyze & Learn from past measurement configurations
  - what people use to do? is it optimal?
  - what can users learn from expert users or from best practices?